Material Forces in Elasticity and Strength-of-Materials

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Classical mechanics, i. e., mechanics in physical space is concerned with forces, stresses and strains and attempts to describe the motion and/or deformation of bodies with mass. In this context, the notion of tractions, trajectories, balance and conservation laws, stability of equilibrium etc. are well established. Dual to this, a whole edifice of a mechanics in material space can be established [1]. Mechanics in material space (or configurational mechanics) describes the behaviour of defects (e. g., voids, dislocations, cracks) as they move relatively to the material in which they find themselves. Concerning this change of configuration, similar notions, as given above, are introduced in material space. Some examples are given in the paper. First, the interaction problem between a circular hole and one or two edge dislocations is treated analytically and numerically. Further, an elementary treatment of fracture mechanics on the basis of strength-of-materials is presented.

References
[1] R. Kienzler, and G. Herrmann, "Mechanics in Material Space," Springer, 2000